Professor Newcomb's two results. Professor Newcomb's second result and Mr. Nevill's are now in close agreement, as is only natural seeing that Mr. Nevill's sixteen years include the thirteen years of Professor Newcomb's second result. The discordance has been decreased from 0″·18 to 0″·08 by the calculations of this paper.

Note on Diurnal Variations of the Nadir and Level of the Transit Circle at the Royal Observatory, Greenwich.

(*Communicated by the Astronomer Royal.*)

In a former paper communicated to the Society in 1899 March it was shown that when the observations of the level and nadir taken at different times of the same day were compared with each other, those observations made about 6 P.M. showed discordances from those made about midday and midnight. The present paper continues these comparisons of the level and nadir near noon, 6 P.M., and midnight for the years 1897–1904. The results for these times are derived from about 100 days in each year in which one observation at least falls within the limits of each group, viz. 9^h–15^h, 15^h–21^h, and 21^h–23^h civil time. In order to carry the discussion through the whole twenty-four hours, observations made between 3^h–9^h have been compared with those obtained between 15^h–21^h on the same or the previous days. There are approximately thirty days in each year when such observations have been made. The results are given in the following table :

Diurnal Changes of Level and Nadir for the years 1897–1904.

Year.	Level.				Nadir.			
	Noon.	6 p.m.	Midnight.	6 a.m.	Noon.	6 p.m.	Midnight.	6 a.m.
	″	″	″	″	″	″	″	″
1897	+0·20	·00	+ ·13	+ ·30	+ ·11	·00	+ ·17	+ ·33
1898	+0·33	·00	+ ·23	+ ·36	+ ·16	·00	+ ·11	+ ·05
1899	+0·29	·00	+ ·18	+ ·30	+ ·17	·00	+ ·19	+ ·24
1900	+0·29	·00	+ ·23	+ ·46	+ ·14	·00	+ ·05	+ ·02
1901	+0·28	·00	+ ·26	+ ·31	+ ·17	·00	+ ·09	+ ·06
1902	+0·21	·00	+ ·20	+ ·34	+ ·20	·00	+ ·17	+ ·09
1903	+0·14	·00	+ ·22	+ ·32	+ ·04	·00	+ ·09	+ ·06
1904	+0·27	·00	+ ·29	+ ·55	+ ·06	·00	+ ·15	+ ·12
Mean	+0·25	·00	+0·22	+0·37	+0·13	·00	+0·13	+0·12

The variation of the level has a period of 24^h with its maximum about 6 A.M. and minimum about 6 P.M. The variations of the nadir are much smaller, and do not show any conclusive result except the discordance near 6 P.M.

On the Influence of Vapour Pressure on Refraction.

By Dr. L. de Ball.

(*Communicated by the Astronomer Royal.*)

The theory of refraction which M. Radau develops in his excellent memoir, "Essai sur les Réfractions astronomiques,"* concerns also the influence of the pressure of the vapours present in the atmosphere.† Although this memoir appeared quite sixteen years ago, refraction, even to this day, is almost without exception computed without any consideration to the dampness of the air. The consequence of this neglect, however, is that the zenith-distances, thus reduced, contain systematic errors of annual period. Since, so far as I know, attention has not yet been called to this point, a brief dissertation on the real state of the matter may not be quite out of place.

Let ρ be the density of the air at the place of observation, c a constant, and put

$$(1) \qquad \frac{c\rho}{1+2c\rho} = a$$

then the refraction for the apparent zenith-distances $z \leqq 75°$ may be represented by the series

$$(2) \quad \text{Refraction} = \frac{a}{\sin 1''}(a_0 \operatorname{tang} z - a_1 \operatorname{tang}^3 z + a_2 \operatorname{tang}^5 z - a_3 \operatorname{tang}^7 z)$$

The value of the coefficient a varies with the density of the air. If the density of the air have the value ρ_0, and we write

$$(3) \qquad \frac{c\rho_0}{1+2c\rho_0} = a_0$$

then the result is at once

$$(4) \qquad a = \frac{\rho}{\rho_0} \frac{a_0}{1-2a_0\left(1-\frac{\rho}{\rho_0}\right)}$$

If, therefore, the real value for any density of the air be known, the value of a for each density can be computed; and when a is known and the temperature besides, the sum of the above series may also be ascertained. The density is found from the readings of the barometer, of the interior and exterior thermometer, in connexion with the vapour-pressure, with the height above sea-level of the place of observation and its geographical latitude;

* *Annales de l'Observatoire de Paris*, t. xix.

† Older theories, in which the influence of the dampness in the air is at least touched upon, are found mentioned in C. Bruhns' *Die astronomische Strahlenbrechung*. C. Bruhns, however, says in conclusion (p. 173): "Rightly, therefore, have Bessel, . . . paid no further attention to the damp air."